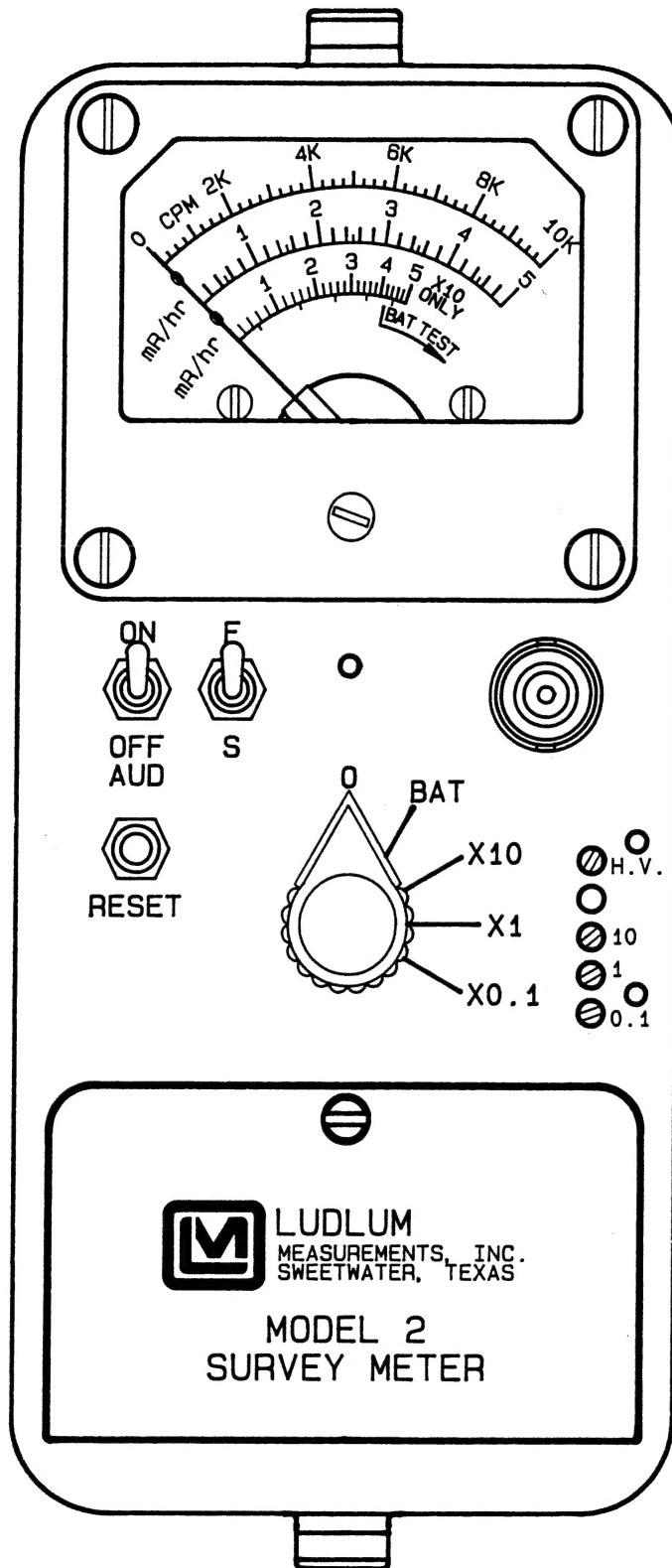


LUDLUM MODEL 2  
SURVEY METER  
SN 70405 & SUCCEEDING  
SERIAL NUMBERS  
OCTOBER 1989



**LUDLUM MEASUREMENTS, INC.**  
**501 OAK ST., P.O. BOX 810**  
**SWEETWATER, TX 79556**  
**915/235-5494 FAX: 915/235-4672**



CHG NO.				DWN	CHK	APP
DWN DATE	8/8/88	CHK DATE		APP DATE		
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TITLE MODEL 2 SURVEY METER						
LUDLUM MEASUREMENTS, INC. 901 DAK STREET SWEETWATER, TEXAS 78208		SERIES	363	SHEET	171	

## **LUDLUM MODEL 2 SURVEY METER**

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## **LUDDLUM MODEL 2 SURVEY METER**

### **1. GENERAL**

The Model 2 is a portable survey instrument that operates on two standard "D" cell flashlight batteries. The instrument features a regulated high voltage power supply adjustable from 400 to 1500 volts.

The unit body is made of cast-aluminum, including the meter housing. The can is 0.090 aluminum. Other operating features of the instrument include a unimorph speaker mounted to the instrument can with an audio ON-OFF capability, fast-slow meter response, meter reset button and a 5-position switch for selecting battery check or scale multiples of X0.1, X1 and X10. Each range multiplier has its own calibration potentiometer.

Any G-M probe offered by the company will operate on this unit as well as many of the scintillator-type detectors. The instrument is set for 900 volts G-M tube operation. For special requirements, it may be adjusted for operation with any G-M or scintillator tube between 400 and 1500 volts.

The unit is operated with two flashlight batteries for operation from 150° to approximately 32°F. For temperature operation to 0°F, either very fresh alkaline or rechargeable NiCd batteries may be used. Battery drain averages 30 milliamperes.

### **2. SPECIFICATIONS**

POWER: two standard "D" size batteries

THREE LINEAR RANGES: from 0 to 100k Counts/minute, 0-50 mR/hr; meter scale presentation - 0 to 10k CPM & 0-5 mR/hr with multiples of X0.1, X1, X10

SENSITIVITY: 30 millivolts, ( $\pm 10$ mV)

AUDIO: built-in unimorph speaker with an ON-OFF switch

HIGH VOLTAGE: externally adjustable from 400 to 1500 volts

RESPONSE: 4 or 22 seconds for 90% of final reading

LINEARITY: plus or minus 5% full scale

CALIBRATION STABILITY: less than 15% variance to battery end point

## **LUDLUM MODEL 2 SURVEY METER**

METER: 1mA, pivot-and-jewel movement, 2 1/2-inch scale

CONNECTOR: Series "C", 706 U/G (BNC or MHV may also be provided).

SIZE: 8.9 (3.5")W X 21.6 (8.5")L X 10.67 (4.2")H exclusive of handle

WEIGHT: 1.36 (3 lbs.) less detector and batteries

### **3. DESCRIPTION OF CONTROLS AND FUNCTIONS**

Range Multiplier Selector Switch is a 5-position switch marked OFF, BAT, X10, X1, X0.1. Turning the range selector switch from OFF to BAT position provides operator a battery check of the instrument. A BAT check scale on the meter provides a visual means of checking the battery status. Moving the range selector switch to one of the range multiplier positions (X0.1, X1, X10) provides the operator with an overall range of 0-50K CPM (0-50 mR/hr if the mR/hr scale is installed). Multiply the scale reading by the multiplier for determining the actual reading.

AUDIO ON-OFF Toggle Switch, in the ON position, operates the unimorph speaker, located on the left side of the instrument. The frequency of the clicks is relative to the rate of the incoming pulses. The higher the rate is, the higher the audio frequency. The audio should be turned OFF when not required to reduce battery drain.

Fast-Slow Toggle Switch provides meter response. Selecting the "F" position of the toggle switch provides 90% of final reading in 4 seconds. In "S" position, 90% of final reading takes 22 seconds. When the instrument is set on "F", there is fast response and large meter deviation. When it is set on "S" position, there is a slow response and damped meter deviation.

RES Button, when depressed, provides a rapid means to drive the meter to zero.

High Voltage Adjustment provides a means to vary the high voltage from 400 to 1500 volts. The high voltage setting may be checked at the connector with an appropriate voltmeter.

## LU DLUM MODEL 2 SURVEY METER

Range Calibration Adjustments are recessed potentiometers located underneath the calibration cover on the right side of the front panel. These adjustment controls allow individual calibration for each range multiplier.

### 4. OPERATING PROCEDURES

NOTE: To open the Battery Lid, twist the lid button counterclockwise 1/4 turn. To close, twist clockwise 1/4 turn.

- 4.1 Open the lid and install two "D" size batteries. Note (+) (-) marks on the inside of the lid. Match battery polarity to these marks.

NOTE: Center post of flashlight battery is positive.

Close the battery box lid.

- 4.2 Switch the range switch to BAT. The meter should deflect to the battery check portion of the meter scale. If the meter does not respond, recheck that the batteries have proper polarity.
- 4.3 Connect the cable to the instrument and detector.
- 4.4 Turn the instrument range switch to X10. Expose the detector to a check source. The speaker should click with the AUDIO ON-OFF switched to ON.
- 4.5 Move the range switch to the lower scales until a meter reading is indicated. The toggle switch labeled F-S should have fast response in "F", slow response in "S".
- 4.6 Depress the RES switch. The meter should zero.
- 4.7 Proceed to use the instrument.

## LUDLUM MODEL 2 SURVEY METER

### 5. CALIBRATION

- 5.1 Detector Operating Point: Adjust the high voltage (HV) control for 900 volts at the instrument connector for G-M detectors.

NOTE: Measure High Voltage with a Model 500 pulser or a High Impedance Voltmeter with a high meg probe. If one of these instruments is not available, use a voltmeter with a minimum of 1000 megohm input resistance.

Turn the instrument to X10. Expose the instrument to a calibrated gamma field and vary the range calibration adjustment control for proper reading.

- 5.2 Special Use Calibration: For special G-M detector applications, the power supply may be adjusted for 450-volt and 1200-volt G-M tubes. Follow the above procedure, except set the supply at the new operating voltage.

For scintillation counters, connect the scintillator. Expose the unit to a source and develop an operating voltage versus count-rate plot. Set the operating voltage at the flattest portion of this curve; then proceed to adjust each calibration control for the desired meter reading.

- 5.3 Calibrating CPM Scale: To calibrate CPM scale, a precision pulse generator is required. The pulse generator should be capable of providing a 40-millivolt or greater negative pulse with a rise time of 1 microsecond and a pulse-width of 5 microseconds.

Connect the pulse generator to the instrument and adjust the pulse frequency to provide 4/5-scale deflection on the X10 range (40,000 CPM). Adjust the X10 range calibration potentiometer as required. Decrease the pulse frequency by one decade and move the range multiplier switch to the X1 position. Adjust the X1 range calibration potentiometer as required (4,000 CPM). Decrease the pulse frequency by another decade. Move the range multiplier to X0.1 and adjust the calibration potentiometer as required (400 CPM).

## 6. MAINTENANCE

NOTE: NEVER STORE THE INSTRUMENT OVER 30 DAYS WITHOUT REMOVING BATTERIES. ALTHOUGH THIS INSTRUMENT WILL OPERATE AT VERY HIGH AMBIENT TEMPERATURES, BATTERY SEAL FAILURE CAN OCCUR AT TEMPERATURES AS LOW AS 100 DEGREES FAHRENHEIT. NEGLECTED BATTERY SEAL FAILURE WILL SURELY CAUSE ONE AWFUL MESS!

Instrument maintenance consists of keeping the instrument clean and periodically checking the batteries and calibration. Once initial calibration is performed, recalibration should not be required if the batteries are maintained in good condition.

An instrument operational check should be performed prior to each use by exposing the detector to a known source and confirming a proper reading on each scale.

Under certain conditions, NRC requires instrument recalibration every three months. Check the appropriate regulations to determine a recalibration schedule.

Also at three month intervals, the batteries should be removed and the battery contacts cleaned of any corrosion. If the instrument has been exposed to very dusty or corrosive atmosphere, more frequent battery servicing should be used.

Use a spanner wrench to unscrew the battery contact insulators, exposing the internal contacts and battery springs. Removing the handle will facilitate access to these contacts.



## LUDLUM MODEL 2 SURVEY METER

### BILL OF MATERIALS

CIRCUIT BOARD, DRAWING 363 X 118

#### CAPACITORS

Part No.

C1	100pF, 3kV, C	04-5532
C2	.01uF, 100V, C	04-5523
C3	470pF, 100V, C	04-5555
C4	100pF, 100V, C	04-5527
C5	.01uF, 100V, C	04-5523
C6	22uF, 20V, OST	04-5579
C7-C8	100uF, 15V, DT	04-5583
C9	4.7uF, 10V, OST	04-5578
C10	.1uF, 100V, C	04-5521
C11	4.7uF, 10V, OST	04-5578
C12	2.2uF, 25V, DT	04-5559
C13	.01uF, 100V, C	04-5523
C14	100uF, 15V, DT	04-5583
C15	100uF, 10V, OST	04-5576
C16	1uF, 35V, OST	04-5575
C17	.1uF, 100V, C	04-5521
C18	100uF, 3kV, C	04-5532
C19	.0027uF, 3kV, C	04-5520
C20-C23	.001uF, 100V, C	04-5518
C24	.01uF, 100V, C	04-5523

#### TRANSISTORS

Q4	MPS6534	05-5763
Q5-Q6	2N3904	05-5755
Q7	MPS6534	05-5763

#### INTEGRATED CIRCUITS

U1	CA3096	06-6023
U2	CD4093	06-6030
U3	CD4098	06-6066
U4	CA3096	06-6023
U5-U6	LM358	06-6024

## LUDLUM MODEL 2 SURVEY METER

### DIODES

CR1	1N34A	07-6253
CR2-CR5	1N4007	07-6274
CR6-CR10	1N4148	07-6272
CR11	LM385 Z-1.2	05-5808

### RESISTORS

R1	22k	10-7070
R2	2.7M	10-7029
R3	10k	10-7016
R4	470k	10-7026
R5	1M	10-7028
R6	12k	10-7048
R7	1M	10-7028
R8	1M	10-7028
R9	3.3k	10-7013
R10	560k	10-7027
R11	100k	10-7023
R12	75k	10-7074
R13	1M	10-7028
R14	2.7M	10-7029
R15	82k	10-7022
R17	33k	10-7019
R20	270 OHM	10-7007
R21	8.2k	10-7023
R22	82k	10-7022
R23	100k	10-7023
R28	SAT (TYP. 715k 1%)	
R29	330 OHM	10-7053
R31	75k	10-7074
R32	10k	10-7016
R33	4.7k	10-7014
R34	100k 1%	12-7557
R35	16.5k 1%	12-7541
R36	10k	10-7016
R37	1k	10-7009
R38	200 OHM	10-7006
R39	10M	10-7031
R40	1M	10-7028
R41	SAT (TYP. 2.2k)	10-7012
R43	1G	12-7686

## **LUDLUM MODEL 2 SURVEY METER**

### **TRANSFORMERS**

T1	L8050	40-0902
T2	LVPS	40-0944

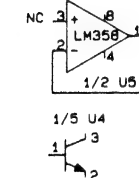
### **MISCELLANEOUS**

7 EACH	CLOVERLEAF RECEPTACLES 011-6809	18-8771
1 EACH (J2)	WALDON 16-06-0007 SMALL RECEPTACLE	18-8792
1 EACH (J1)	WALDON 16-06-0004 LARGE PIN	18-8795

ASSEMBLED CIRCUIT BOARD	5363-147
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NO.	DEVICE	POWER CONNECTIONS	
		+8.5V	GND
U1	CA3098	16	7
U2	CD4093	14	7
U3	CD4098	16	8
U4	CA3098	16	16
U5	LM358	8	4
U6	LM358	8	4

# UNUSED CONNECTIONS

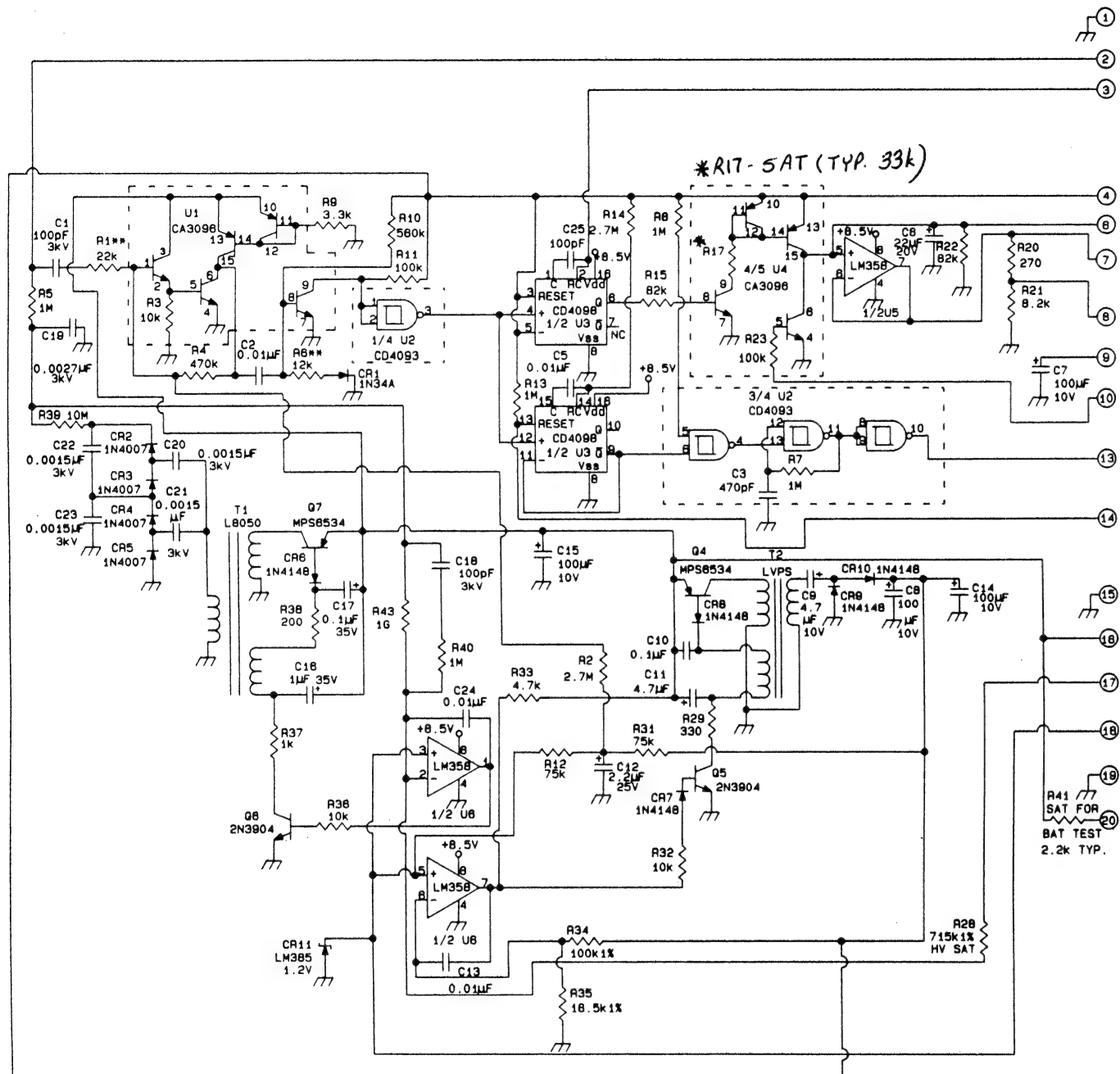


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MODEL:	MODEL 2
PART #:	5363-147
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DATE:	10-8-88
DSGN:	DATE:

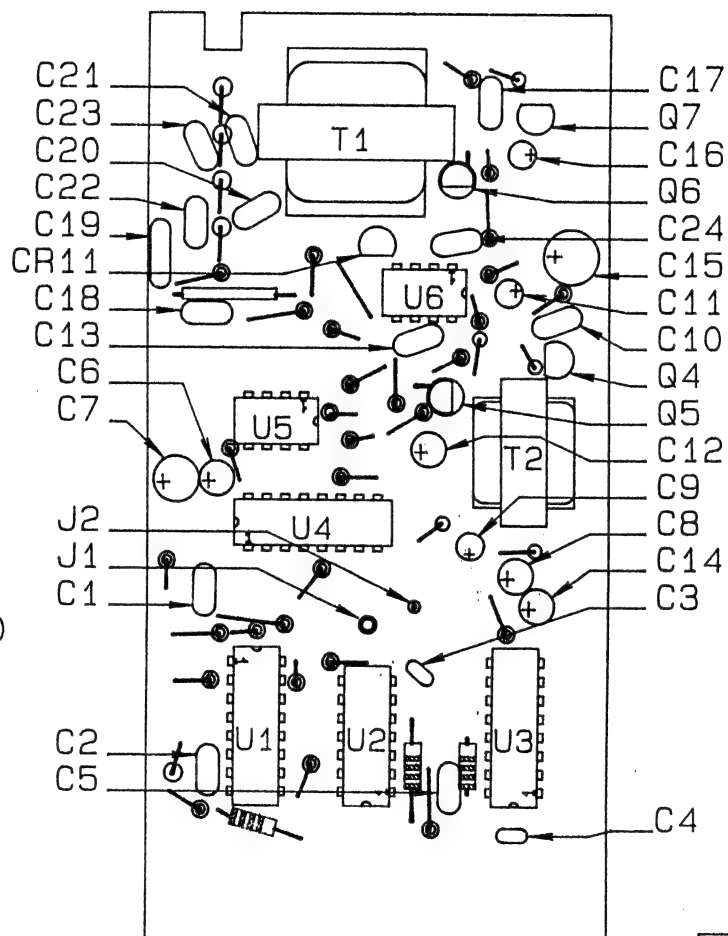
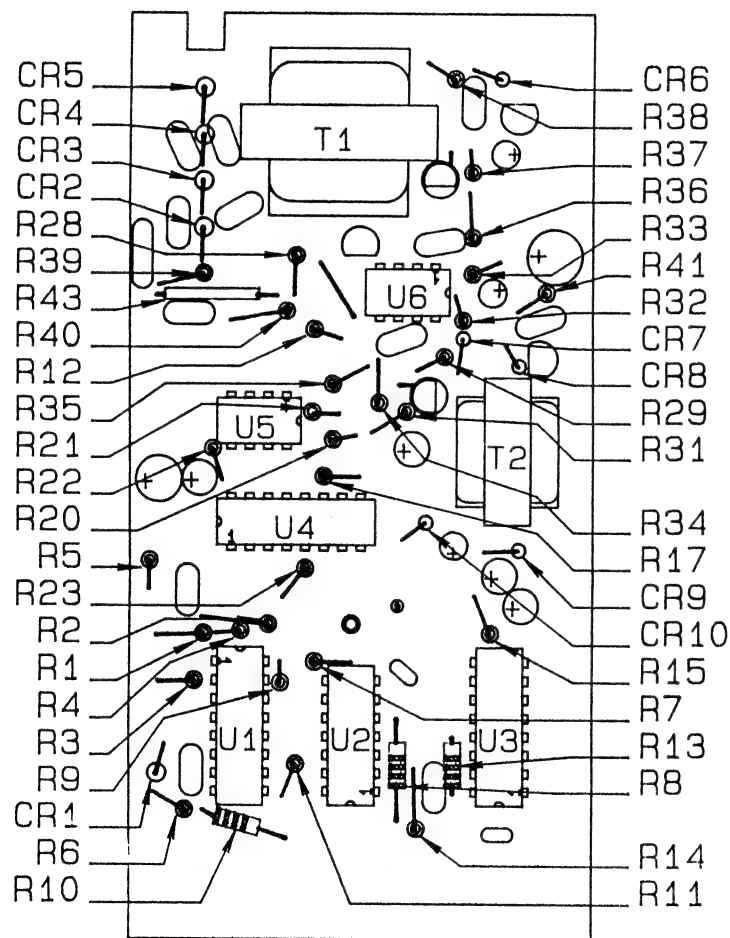
\*\*FOR 10mV INPUT SENSITIVITY:

R1 = 10k  
R8 = 24k

\* R17 - 15k, 22k, 33k  
Resistor selected to  
match meterface.



CHG NO.		DWN	CHK	APP
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BK		U6	10/14/89	
TOL:	SHOP STD	SCALE:	FULL	OTHER
TITLE	MODEL 2 SURVEY METER	SERIES		SHEET
	LUZLUM MEASUREMENTS, INC.			
	501 OAK STREET			
	SWEETWATER, TEXAS 79558			



DESC: MODEL 2 CIRCUIT BOARD	
BOARD #: 5363-147	
DWN: BK	DATE: 10-6-88
DSGN:	DATE:

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LUDLUM MEASUREMENTS, INC.		SERIES		SHEET
801 OAK STREET		363		130
SHELVING, TEXAS 78066				

## **LUDLUM MODEL 2 SURVEY METER**

### **BILL OF MATERIALS**

CHASSIS WIRING DIAGRAM, DRAWING NO. 363 X 219

#### **AUDIO**

PART NO.

DS1	UNIMORPH 60690	21-9251
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#### **CONNECTOR**

P1	RIBBON-050-010-455 10P	13-8064
J1	RECPT-UG706/U SCREW-IN C	13-7751

#### **SWITCHES**

S1	CENTRALAB PA600-210	08-6501
S2	RESPONSE F/S MST 105-D	08-6511
S3	AUDIO ON-OFF MST 105-D	08-6511
S4	RESET 30-1 P/B	08-6517

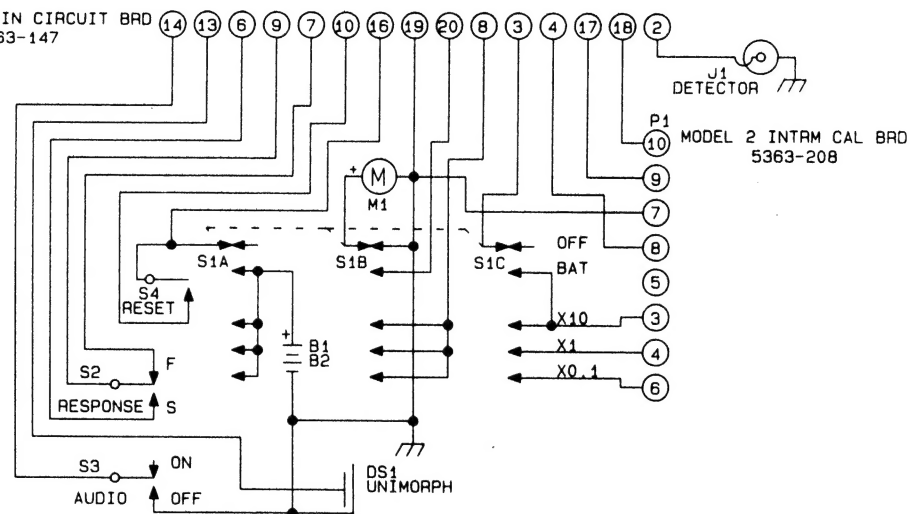
#### **BATTERY**

BT1-BT2	"D" DURACELL BATTERY	21-9313
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#### **MISCELLANEOUS**

*	MODEL 2 BATT LID W/LATCH SET	9363-206
*	MODEL 295 BATTERY CONTACT SET	40-1707
*	PORT LATCH KIT W/O BATT LID	4363-349
*	MODEL 2 CASTING	9363-205
*	MODEL 3/2 MAIN HARNESS	8176-020-00
*	MODEL 3/2 RIBBON HARNESS	8363-020
*	PORTABLE CAN ASSY	4363-189
*	PORTABLE KNOB	08-6613
*	PORTABLE BEZEL FRONT ASSY	4363-188
*	PORT METER W/GLASS W/O SCREWS	4363-352
*	PORT CAL COVER W/SCREWS	9363-200
*	UNIMORPH W/WIRES & O'RING	40-0034
*	PORT HANDLE (GRIP) W/SCREWS	7363-139
*	PORT HANDLE FOR CLIP W/SCREWS	7363-203
*	CLIP (44-2, 44-3 TYPE) W/SCREWS	7002-026-01
*	CLIP (44-7 TYPE) W/SCREWS	7010-007-01
*	CLIP (44-6 TYPE) W/SCREWS	7010-008-01

MODEL 2 MAIN CIRCUIT BRD  
5363-147



DESC: WIRING DIAGRAM	
MODEL: 2	
PART #: 363-283	
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DSGN: DL	DATE: 6/87

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OTHER				OTHER				
TITLE								
MODEL 2 SURVEY METER								
LUDLUM MEASUREMENTS, INC. 901 OAK STREET SWEETWATER, TEXAS 79556				SERIES		SHEET		
				363		219		

## **LUDLUM MODEL 2 SURVEY METER**

### **BILL OF MATERIALS**

CALIBRATION BOARD, DRAWING NO. 363 X 212

#### **CAPACITORS**

C1	.0047uF 100V C X7R	04-5565
C2	.047uF 100V C X7R	04-5570

#### **RESISTORS**

R1-R3	1 MEG TRIMMER	09-6814
R5	100K TRIMMER	09-6813

#### **RESISTOR NETWORK**

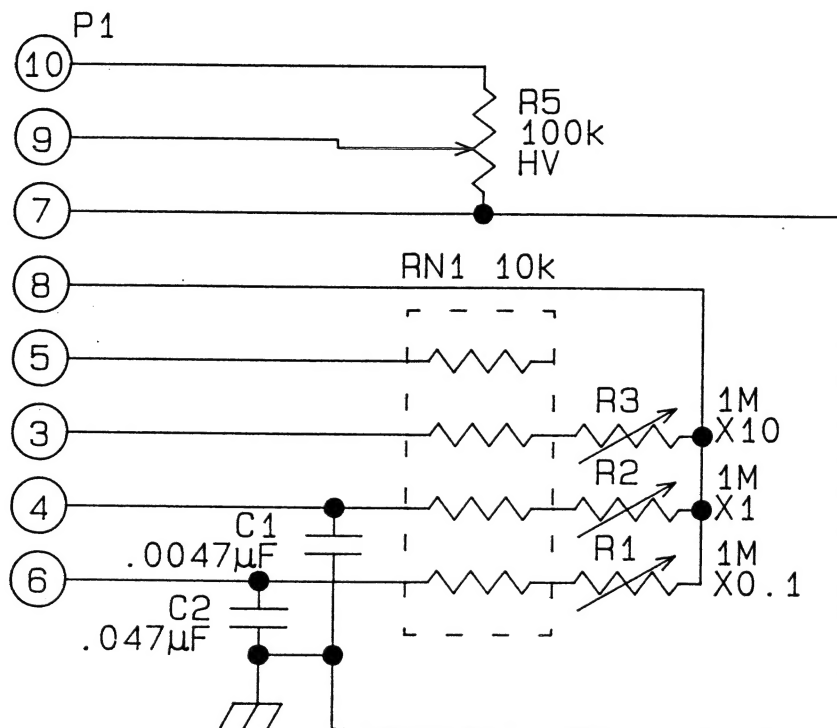
RN1	NETWORK-10K SIP 8PIN	12-7720
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#### **MISCELLANEOUS**

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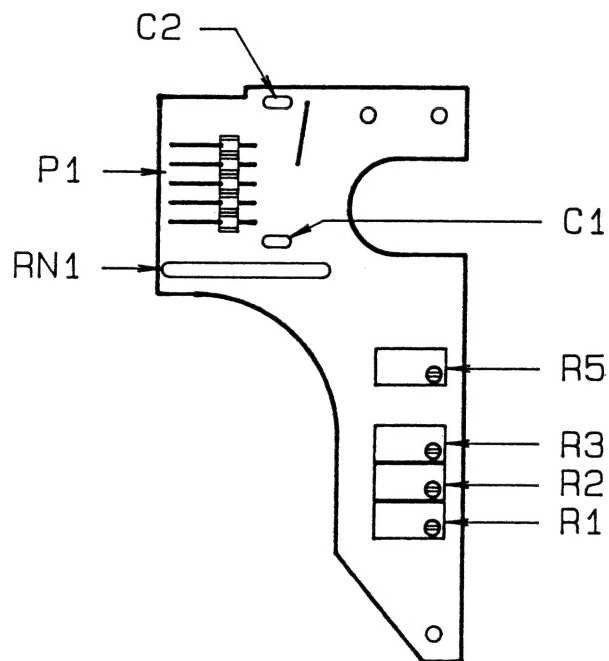
ASSEMBLED CALIBRATION BOARD	5363-208
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LUDLUM MEASUREMENTS, INC.		SERIES	SHEET	
201 OAK STREET		363	212	
BIRMINGHAM, TEXAS 77608				



DESC: CALIBRATION BOARD	
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DSGN:	DATE:

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		363	213	